

AMENDMENTS TO THE CLAIMS

The listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

1. (Original) A supported noble metal catalyst wherein the noble metal comprises nanometer-sized crystal particles contained on a support material within a matrix comprising a particle-to-support control and binding agent, said particles having a preponderance of (111) type of crystal phase on the face of the noble metal particles.
2. (Currently Amended) The catalyst of claim 1 wherein the support material includes a porous support material.
3. (Currently Amended) The catalyst of claim 1 wherein the ~~substrate~~ support material is selected from the group consisting of activated carbon, carbon black, fluoridated carbon, alumina, bentonite, clays, diatomaceous earth, synthetic and natural zeolites, magnesia, titania, and polymeric materials.
4. (Currently Amended) The catalyst of claim 1 wherein the support material has a surface area of at least 20 square meters per gram.
5. (Original) The catalyst of claim 1 wherein at least one-half of the crystal phases of the face of the noble metal particles comprise the (111) type of crystal phase.
6. (Original) The catalyst of claim 1 wherein the control and binding agent comprises a metallo-organic sequestering agent.
7. (Original) The catalyst of claim 6 wherein the sequestering agent comprises polyfunctional low molecular weight carboxylic acids and/or branched polyfunctional polymeric carboxylic acids.

8. (Original) The catalyst of claim 6 wherein the sequestering agent comprises glycolic acid.

9. (Original) The catalyst of claim 1 wherein the particle size of the nanometer-sized crystals is less than 5 nanometers.

10. (Currently Amended) The catalyst of claim 1 wherein the particle size of the nanometer-sized crystals is ~~preferably~~ less than 2 nanometers.

11. (Currently Amended) The catalyst of claim 1 wherein the noble metal is selected for the group consisting of platinum, palladium, rhenium, rhodium, ruthenium, osmium, ~~and iridium, silver, and gold.~~

12. (Original) The catalyst of claim 1 wherein the noble metal comprises 0.01% to 10% of the total catalyst weight.

13. (Currently Amended) The catalyst of claim 12 wherein the noble metal comprises ~~0.1 to 0.5%~~ 0.1% to 5% of the total catalyst weight.

14. (Original) The catalyst of claim 1 wherein said particles further include metals other than noble metals including iron, nickel, copper and tin.

15. (Currently Amended) A method for preparing a supported noble metal catalyst having nanometer-sized crystal particles, said particles having a preponderance of (111) type of crystal phase on the face of the noble metal particles, comprising:

- (a) preparing a solution of a noble metal salt and a metallo-organic sequestering agent;
- (b) treating the solution of sequestered noble metal with a reducing agent;
- (c) impregnating a catalyst support with the reduced noble metal solution; and
- (d) activating the catalyst by reducing the ~~dried~~ impregnated support to yield the nanometer-sized noble metal catalyst having a preponderance of (111) type of crystal phase on the face of the noble metal particles.

16. (Original) The method of claim 15 wherein the solution is an aqueous solution of noble metal and the sequestering agent comprises glycolic acid with a ratio of metal to agent of between 1:0.5 and 1:10.

17. (Currently Amended) The method of claim 15 wherein the ~~dried~~ impregnated support is reduced by hydrogenation at a temperature between 100 and 400 degrees C.

18. (Currently Amended) The method of claim 15 wherein the supported activated catalyst has a noble metal loading of between 0.01 and 10 weight percent.

19. (Original) The method of claim 15 wherein the support is selected from the group consisting of activated carbon, carbon black, fluoridated carbon, alumina, bentonite, clays, diatomaceous earth, synthetic and natural zeolites, magnesia, titania, and polymeric materials.

20. (Original) The method of claim 15 wherein the solution of sequestered noble metal is treated with a reducing agent comprising hydrogen gas.

21. (Original) The method of claim 15 wherein the solution comprising noble metal salt and a metallo-organic sequestering agent is treated with a reducing agent comprising hydrogen gas.

22. (Cancelled).

23. (New) The catalyst of claim 1 wherein the noble metal particles further comprise at least one component selected from the group consisting of transition metals, alkali metals, alkaline earth metals, rare earth metals, or non-metals.

24. (New) A method of catalytically treating a hydrocarbon feedstock, comprising:
mixing or contacting the hydrocarbon feedstock with the catalyst of claim 1; and
performing at least one catalytic treatment selected from the group consisting of:

- (a) catalytic reforming of naphtha;
- (b) cyclization of an aliphatic hydrocarbon;
- (c) aromatization of an aliphatic hydrocarbon;
- (d) hydrogenation of a hydrocarbon;
- (e) dehydrogenation of a hydrocarbon;
- (f) steam reformation of a hydrocarbon;
- (g) partial oxidation of a hydrocarbon;
- (h) production of synthesis gas; and
- (i) dissociative adsorption of hydrogen and oxygen.

25. (New) The method of claim 24, wherein the hydrocarbon feedstock comprises at least one of methane, gasoline, kerosene, diesel fuel, methanol, or ether.

26. (New) A supported metal catalyst, comprising:
a support material;
a plurality of metal catalyst particles disposed on the support material, the catalyst particles having a preponderance of (111) type of crystal phase on the face of the metal catalyst particles; and
a control and binding agent comprising at least one type of polymer, oligomer, or organic compound that binds the active catalyst particles to the support material.
27. (New) The supported active catalyst of claim 26, wherein the support material is selected from the group comprising activated carbon, carbon black, fluoridated carbon, alumina, bentonite, clays, diatomaceous earth, synthetic zeolites, natural zeolites, magnesia, titania, and polymeric materials.
28. (New) The supported active catalyst of claim 26, wherein at least half of the crystal phases of the face of the metal catalyst particles comprise the (111) type of crystal phase.
29. (New) The supported active catalyst of claim 26, wherein the metal catalyst particles are less than 5 nanometers in size.
30. (New) The supported active catalyst of claim 26, wherein the metal catalyst particles are less than 2 nanometers in size.
31. (New) The supported active catalyst of claim 26, wherein the metal catalyst particles comprise at least one noble metal selected from the group consisting of platinum, palladium, rhenium, rhodium, ruthenium, osmium, iridium, silver, and gold.
32. (New) The supported active catalyst of claim 31, wherein the metal catalyst particles comprise 0.01% to 10% by weight of the at least one noble metal.
33. (New) The supported active catalyst of claim 31, wherein the metal catalyst particles comprise 0.1% to 5% by weight of the at least one noble metal

34. (New) The supported active catalyst of claim 26, wherein the metal catalyst particles comprise at least one metal selected from the group consisting of nickel, tin, copper, and iron.

35. (New) The supported active catalyst of claim 26, wherein the metal catalyst particles comprise at least one transition metal.

36. (New) The supported active catalyst of claim 26, wherein the active catalyst particles comprise at least two different types of metals.

37. (New) The supported active catalyst of claim 26, wherein the control and binding agent is selected from the group consisting of small organic molecules, branched, cross-linked, or non-linear ionic polymers, branched, cross-linked, or nonlinear oligomers, and combinations thereof.

38. (New) The supported active catalyst of claim 26, wherein the control and binding agent is a small organic molecule containing at least two functional groups.

39. (New) The supported active catalyst of claim 38, wherein the at least two functional groups comprise an OH group and/or a COOH group.

40. (New) The supported active catalyst of claim 38, wherein the control agent comprises a low molecular weight polyfunctional carboxylic acid and/or a branched polyfunctional polymeric carboxylic acid.

41. (New) The supported active catalyst of claim 26, wherein the control agent is selected from the group comprising glycolic acid, citric acid, branched or cross-linked polyacrylic acid, combinations thereof, and salts thereof.

42. (New) The supported active catalyst of claim 26, wherein the metal catalyst particles comprise an additional component selected from the group consisting of alkali metals, alkaline earth metals, and non-metals.

43. (New) A method of manufacturing a supported metal catalyst, comprising:

(a) preparing an intermediate catalyst complex by reacting together:

(i) a plurality of cations of metal catalyst atoms; and

(ii) a control and binding agent comprising a plurality of molecules selected from the group consisting of polymers, oligomers, and organic compounds;

(b) contacting the intermediate catalyst complex with a support material; and

(c) removing a portion of the control agent to expose a portion of the metal catalyst atoms, thereby yielding a supported catalyst comprising a plurality of metal catalyst particles (i) that are bonded to the support material by a remaining portion of the control and binding agent and (ii) that have a preponderance of (111) type of crystal phase on the face of the metal catalyst particles.

44. (New) The method of claim 43, wherein the metal catalyst atoms comprise at least one noble metal selected from the group comprising platinum, palladium, rhenium, rhodium, ruthenium, osmium, iridium, silver, and gold.

45. (New) The method of claim 43, wherein the metal catalyst atoms comprise at least one of nickel, tin, copper, or iron.

46. (New) The method of claim 43, wherein (a) comprises reacting the cations of the metal catalyst atoms and control agent in a solution.

47. (New) The method of claim 43, further comprising bonding a portion of the control agent with the support material.

48. (New) The method of claim 43, wherein bonding a portion of the control agent with the support material yields an intermediate composition comprising a liquid and said catalyst complex bonded to said support material, the method further comprising drying the intermediate composition.

49. (New) The method of claim 43, wherein (c) comprises reducing the portion of control agent.

50. (New) The method of claim 43, wherein (c) comprises hydrogenating the portion of the control agent.

51. (New) The method of claim 43, further comprising heat treating the supported catalyst obtained in (c) at a temperature in a range of about 100°C to about 400°C.

52. (New) The method of claim 43, wherein the metal catalyst particles comprise at least two different types of catalyst atoms.

53. (New) The method of claim 43, wherein the intermediate catalyst complex formed in (a) comprises a molar ratio of catalyst atoms to control agent in a range of about 1:0.5 to about 1:10.

54. (New) A method of using the supported metal catalyst of claim 26, comprising contacting one or more reactants with the supported metal catalyst so as to yield one or more desired reaction products.

55. (New) The method of claim 54, wherein the one or more reactants are hydrogenated to yield the one or more desired reaction products.

56. (New) The method of claim 54, wherein the one or more reactants are selected from the group consisting of olefins, acetylenes, carbonyls, aromatics, carboxylic acids, anthraquinones, imines, nitriles, nitro compounds, nitroso compounds, pyridines, carbon monoxide, and carbon dioxide.

57. (New) The method of claim 54, wherein the one or more reactants are dehydrogenated to yield the one or more desired reaction products.

58. (New) The method of claim 57, wherein the one or more desired reaction products are selected from the group consisting of reformed naphtha, cyclized aliphatic hydrocarbons, aromatized aliphatic hydrocarbons, compounds with dehydrogenated alcohols.

59. (New) The method of claim 54, wherein the one or more reactants are selected from the group consisting of methane, gasoline, kerosene, diesel fuel, methanol and ether.

60. (New) The method of claim 54, wherein the supported metal catalyst catalyzes a at least one half-cell electrochemical reaction in a hydrogen/oxygen fuel cell, the at least one half-cell electrochemical reaction comprising at least one of a hydrogenation or a dehydrogenation reaction.